WE CLAIM:

1. A cell adhesion promoting (CAP) peptide-modified polymer composition useful for promoting cell attachment or growth, comprising a polymer surface made of/with a cell adhesion resistant (CAR) material to which one or more peptides are covalently bound, forming a peptide-modified CAP surface, which peptides/surface promote[s]:

(i) attachment of cells, which cells substantially do not attach to said CAR surface in the absence of said peptides and,

(ii) optionally, growth, differentiation or enhanced survival of cells that have attached to the peptide-modified surface, which cells substantially do not attach to, grow, differentiate or manifest enhanced survival on, said CAR surface in the absence of said peptides.

2. The composition of claim 1 wherein said one or more peptides has a length of no more than about 30 amino acids and when covalently bound to a CAR surface alone or in combination with other peptides, promotes cell attachment, wherein said peptide comprises:

(a) one or more pentapeptide, tetrapeptide or tripeptide sequences selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK);

(b) a chemically or recombinantly prepared peptide multimer that includes at least two repeats of any one or a combination of SEQ ID NOs 1-16;

(c) a cell-adhesion promoting variant of any one or more of (1)-(16) having the same amino acid composition but in a different sequence; or

(d) a cell adhesion promoting substitution variant of SEQ ID NOs 1-16.

3. The composition of claim 2 wherein said one or more peptides is a combination selected from the following group:

(a) BD Factor 3;

(b) BD Factor 4;

(c) BD Factor 5;

(d) BD Factor 8; and

(e) any combination of (a)-(d).

4. The composition of claim 2 wherein said peptide is a chemically synthesized multimer having the formula $\mathbf{P^1}_n$ wherein

(a) in each of the n repeating units, $\mathbf{P^1}$ can be the same or different peptide selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK);

(b) a cell-adhesion promoting variant of any one or more of (1)-(16) having the same amino acid composition but in a different sequence; and

(c) a substitution variant of any one or more of SEQ ID NOs: 1-16;

wherein, n=2-10.

5. The composition of claim 2 wherein said chemically synthesized multimer has the formula $(\mathbf{P^1}\text{-}\mathbf{X}_m)_n\text{-}\mathbf{P^2}$, wherein

(a) $\mathbf{P^1}$ and $\mathbf{P^2}$ are peptides selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4

(GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK),

(b) a cell-adhesion promoting variant of any one or more of (1)-(16) having the same amino acid composition but in a different sequence; and

(c) a cell-adhesion promoting substitution variant of any of (1)-(16). and

wherein

$\mathbf{P^1}$ and $\mathbf{P^2}$ are the same or different peptides;

X is C_1-C_5 alkyl, C_1-C_5 alkenyl, C_1-C_5 alkynyl, or C_1-C_5 polyether containing up to 4 oxygen atoms;

m = 0 or 1; and

n = 1-7.

6. The composition of claim 2 wherein said recombinantly produced peptide multimer has the formula $\mathbf{(P^1\text{-}Gly_z)_n\text{-}P^2}$, wherein:

(i) $\mathbf{P^1}$ and $\mathbf{P^2}$ are are peptides selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK), a cell-adhesion promoting variant of any one or more of (1)-(16) having the same amino acid composition but in a different sequence; and a cell-adhesion promoting substitution variant of any of (1)-(16);

(ii) P^1 and P^2 are the same or different;

(iii) z = 0-6; and

(iv) n = 1-100.

7. The composition of claim 3 wherein said one or more peptides is selected from BD Factor 3.

8. The composition of claim 3 wherein said one or more peptides is selected from BD Factor 4.

9. The composition of claim 3 wherein said one or more peptides is selected from BD Factor 5.

10. The composition of claim 3 wherein said one or more peptides is selected from BD Factor 8.

11. The composition of claim 2 wherein the peptide combination further comprises a peptide of no more than about 30 amino acids having the RGD sequence.

12. The composition of claim 11 where the peptide with the RGD sequence comprises the sequence GRGDS.

13. The composition of claim 1 wherein said CAR material is selected from the group consisting of hyaluronic acid (HA), alginic acid (AA), polyethylene glycol (PEG), polyethylene oxide (PEO), and polyhydroxyethyl methacrylate (poly-HEMA).

14. The composition of claim 13 wherein said CAR material is HA.

15. The composition of claim 1 wherein said peptide-modified polymer composition is in the form of a 3-dimensional (3D) scaffold.

16. The composition of claim 1 wherein said peptide-modified polymer surface is in the form of a flexible material.

17. The composition of claim 16 wherein the flexible material is a polydimethyl siloxane (PDMS) or another silicone-based polymer.

18. A composition comprising an isolated peptide or polypeptide of no more than about 30 amino acids, which, when covalently bound to a CAR surface alone or in combination with other peptides, promotes cell attachment, wherein said peptide or polypeptide comprises:

(a) one or more peptides selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK);

(b) a chemically or recombinantly prepared peptide multimer that includes at least two repeats of any one or a combination of sequences of SEQ ID NOs1-16;

(c) a cell-adhesion promoting variant of any one or more of SEQ ID NOs 1-16 having the same amino acid composition but in a different sequence; or

(d) a cell adhesion promoting substitution of SEQ ID NOs 1-16.

19. The composition of claim 18 comprising a combination selected from the group consisting of:

(a) BD Factor 3;

(b) BD Factor 4;

(c) BD Factor 5;

(d) BD Factor 8; and

(e) any combination of (a)-(d).

20. The composition of claim18 wherein said peptide or polypeptide is a chemically synthesized multimer having the formula $\mathbf{P^1}_n$ wherein

(a) $\mathbf{P^1}$ is selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK), a cell-adhesion promoting variant of any one or more of SEQ ID NOs 1-16 having the same amino acid composition but in a different sequence and a substitution variant of any one or more of SEQ ID NOs 1-16; and

(b) **n**=2-10.

21. The composition of claim 18 wherein said chemically synthesized multimer has the formula $(\mathbf{P^1}\text{-}\mathbf{X_m})_n\text{-}\mathbf{P^2}$, wherein

(a) $\mathbf{P^1}$ and $\mathbf{P^2}$ are peptides selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI),

SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK), a cell-adhesion promoting variant of any one or more of SEQ ID NOs 1-16 having the same amino acid composition but in a different sequence and a substitution variant of any one or more of SEQ ID NOs 1-16; and

(b) $\mathbf{P^1}$ and $\mathbf{P^2}$ are the same or different peptides;

(c) **X** is C_1-C_5 alkyl, C_1-C_5 alkenyl, C_1-C_5 alkynyl, or C_1-C_5 polyether containing up to 4 oxygen atoms;

(d) **m** = 0 or 1; and

(e) **n** = 1-7.

22. The composition of claim18 wherein said recombinantly produced peptide multimer has the formula $(P^1\text{-}Gly_z)_n\text{-}P^2$, wherein:

(i) P^1 and P^2 are peptides selected from the group consisting of SEQ ID NO: 1 (FIKFG), SEQ ID NO: 2 (EFIKY), SEQ ID NO: 3 (EEEKV), SEQ ID NO: 4 (GHK), SEQ ID NO: 5 (FIFAK), SEQ ID NO: 6 (KKLVY), SEQ ID NO: 7 (AFKIF), SEQ ID NO: 8 (AFAFK), SEQ ID NO: 9 (FAKFI), SEQ ID NO: 10 (KMLIY), SEQ ID NO: 11 (KSYYY), SEQ ID NO: 12 (AKKMV), SEQ ID NO: 13 (FKFIG), SEQ ID NO: 14 (AFIPV), SEQ ID NO: 15 (KKMYY), and SEQ ID NO: 16 (AIKKK), a cell-adhesion promoting variant of any one or more of SEQ ID NOs 1-16 having the same amino acid composition but in a different sequence and a substitution variant of any one or more of SEQ ID NOs 1-16; and

(ii) P^1 and P^2 are the same or different;

(iii) z = 0-6; and

(iv) n = 1-100.

23. A cell culture system comprising the peptide-modified polymer composition of claim 1 that is (i) in the form of a cell culture vessel, or (ii) added to a cell culture vessel.

24. The cell culture system as in claim 23 wherein said vessel is multiwell microplate.

25. A cell culture comprising

(a) the system of claim 23; and

(b) cells in a culture medium.

26. A method for producing a peptide-modified polymer composition useful for selective cell attachment and/or growth, comprising the step of treating a CAR surface with one or more peptides that promote cell attachment and/or growth so that said peptides become covalently bonded thereto, thereby producing said peptide-modified polymer composition.

27. A method for producing a peptide-modified polymer composition useful for selective cell attachment and/or growth, comprising the steps of:

(a) providing a polymer surface;

(b) treating said surface with a CAR material to produce a CAR surface;

(b) treating said CAR surface with a combination of peptides that promote cell attachment and/or growth so that said peptides become covalently bonded thereto, thereby producing said peptide-modified polymer composition.

28. A method of producing the peptide-modified polymer composition of claim 1 comprising the steps of:

(a) providing a polymer surface;

(b) treating said surface with a CAR material to produce a CAR surface; and

(c) treating said CAR surface with peptides so that said peptides become covalently bound thereto,

thereby producing said peptide-modified polymer composition.

29. A method for attaching cells to a peptide-modified CAR polymer surface comprising:

(a) providing the composition of claim 1;

(b) adding adherent cells to composition; and

(c) allowing said cells to attach to said peptide-modified surface.

30. A method for growing adherent cells on a peptide-modified CAR polymer surface, comprising:

(a) providing a layer of adherent cells in a growth-promoting culture medium, which layer is produced in accordance with claim 25;

(b) optionally, removing unattached (nonadherent) cells;

(c) incubating said attached (adherent) cells in the medium for a selected period of time under conditions that support cell growth;

thereby growing said adherent cells.

31. The method of claim 30 wherein said cells are fibroblasts or osteoblasts.

32. A method of screening a test peptide or peptides for the ability to promote cell attachment and/or growth when covalently bonded to a CAR surface, the method comprising the steps of:

(a) providing the composition of claim 1 in the form of a cell culture vessel or added to a cell culture vessel, wherein said one or more peptides comprising the peptide-modified surface is or are the test peptide or peptides;

(b) in a parallel culture vessel, providing a negative control polymer surface that has no peptides bound thereto or that which is modified with negative control peptides that do not promote cell attachment or growth;

(c) adding cells in culture medium to the culture vessels of (a) and (b);

(d) at one or more selected times thereafter, assessing the number of viable, adherent cells in said the culture vessels,

wherein an increased number of adherent cells in the test vessel (a) compared to the negative control vessel (b) indicates that said test peptide or peptides promote cell attachment and/or growth.

33. The method of claim 32, further comprising, before (c), the step of:

(e) in a parallel culture vessel, providing a positive control surface polymer comprising one or more peptides that are known to promote cell attachment and/or growth,

wherein, the number of viable adherent cells in said positive control vessel (e) exceeds the number of viable adherent cells in said negative control vessel (b).

34. The method of claim 32 wherein said culture vessels are wells of multiwell microplates.

35. The method of claim 32 wherein said CAR surface comprises a CAR material selected from the group consisting of HA, AA, PEG and poly-HEMA

36. The method of claim 35 wherein said CAR material is HA.

37. The method of claim 32 wherein said CAR surface is a 3D matrix scaffold.

38. The method of claim 31 wherein said CAR surface is in the form of a flexible material.

39. The method of claim 32 wherein said cells are fibroblasts or osteoblasts.

40. The method of claim 39 wherein said fibroblasts are NIH3T3 cells and said osteoblasts are MC3T3 cells.

41. The composition of claim 3 wherein said one or more peptides is an individual peptide or a combination of peptides selected from BD factors 4 and 5.

42. The composition of claim 41 wherein the peptide combination is BD factor 4.

43. The composition of claim 41 wherein the peptide combination is BD factor 5.

44. The composition of claim 41 wherein the peptide combination is one or more peptides selected from FIFAK, AFKIF, FAKFI and KKLVY.

45. The composition of claim 41 wherein the peptide combination is FIFAK, AFKIF, FAKFI and KKLVY.

46. The composition of claim 41 wherein the peptide combination is BD factor 4 and BD factor 5.

47. The composition of claim 41 wherein the peptide combination is AFKIF and KKLVY.

48. The composition of claim 41 wherein the peptide combination is FIFAK and KKLVY.

49. The composition of claim 41 wherein the peptide combination is AKKMV and KMLIY.

50. The composition of claim 41 wherein the peptide combination is FAFKI and KKLVY.

51. The composition of claim 41 wherein the peptide combination is KKLVY and KSYYY.

52. The composition of claim 41 wherein the peptide combination is AFKIF and FIFAK.

53. The composition of claim 41 wherein the peptide combination is AFKIF and KSYYY.

54. The composition of claim 41 wherein the peptide combination is AFKIF and AFAFK.

55. The composition of claim 41 wherein the peptide combination is AFKIF and AKKMV.

56. The composition of claim 41 wherein the peptide combination is AFKIF and FAFKI.

57. The composition of claim 41 wherein the peptide combination is FIFAK.

58. The composition of claim 41 wherein the peptide combination is AFKIF.

59. The composition of claim 41 wherein the peptide combination is FAKFI.

60. The composition of claim 41 wherein the peptide combination is KKLVY.

61. The composition of claim 41 wherein the peptide combination is AFAFK.

62. The composition of claim 41 wherein the peptide combination is KSYYY.

63. The composition of claim 41 wherein the peptide combination is KMLIY.

64. The composition of claim 41 wherein the peptide combination is AKKMV

65. The method of claim 30 wherein said cells are liver cells.

66. The method of claim 30 wherein said cells are human or rat primary hepatocytes or porcine hepatocytes.